Nigerian J. Anim. Sci. 2020 Vol 22 (2):222-227 (ISSN:1119-4308)

Effect of different feeds on growth performance of *Archachatina marginata*

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***Target Audience:** Snail farmers; Animal Breeders; Researchers; Students*

Abstract

An 8week completely randomized design [CRD] feeding trial was conducted to determine the growth performance of snails (Archachatina marginata) fed with five different feed materials.-Forty Juvenile snails were allotted to five treatments, replicated twice with 4 snails/replicate. Snails were fed Treatment 1 (Chicken mash as the control), Treatment 2(Water melon peel), Treatment 3 (Oil palm fruit), T4 (Cocoyam leaves) and T5 (Sweet potatoes leaves), using a trench cage. The snails were obtained from a reputable market in Ekiti State and acclimatized for two weeks and fed for eight weeks. Data was collected on weekly basis by measuring growth parameters; shell length increase (cm), shell circumference (cm), and weight gain (g). Proximate analysis of the feed revealed that Moisture content and crude protein in Water melon peel (38.12% and 14.17%) were higher than oil palm fruit (28.01% and 7.64%); sweet potato leaves (28.17% and 7.96%) and Cocoyam leaves (23.74% and 7.66%). Considering the weight gained, chicken mash (control) (41.75±19.16) and water melon peel (30.13±2.71g) were significantly ($p<0.05$) higher than oil palm fruit (27.88±2.80g); cocoyam leaves (18.38±7.38g) and sweet potato leaves (14.75±0.40g). Thus, water melon peel could be exploited as a cheap feed resource for small holder snail production in the humid tropics.

***Keywords:** Snails, Water melon peel, Sweet potato leaves, Cocoyam leaves, Oil palm fruit, Growth*

Description of problem

Archachatina marginata is one of the African Giant Land Snails (AGLS) and is classified as micro livestock which is a non-conventional wildlife protein source. The survival, growth, development and reproduction of snails like that of other species depend highly on housing and quality of feed consumed. In the past, snail production was given little or no attention because of limited awareness of its nutritional and medicinal potentials. It is a vital animal species of good protein source of high biological value, generates high income, and has high market demand since many people are avoiding red meat (1). Their high protein, low fat and cholesterol content make them a nutritional favorite.

Accelerated deforestation has rendered local gathering of snails from the wild a very difficult task because of rapidly declining snail populations. The consequence is that local communities are not able to satisfy demand for both subsistence and commerce. But snail farming could be combined with other businesses and reared at the backyard (2). And although alternative strategies are being sought to boost production, they are also plagued with some difficulties. One major obstacle to efficient snail production in intensive and semi-intensive management system is high cost of commercial feed materials. In livestock

farming feed cost is responsible for 60-70 % of the total cost of production (3). Additionally, despite the fact that Onadeko *et al.* (4), reported that African giant land snails are herbivores (feeding on wide range of plant materials, fruits and vegetables), knowledge on feed sources by many snail farmers is limited. Moreover, the nutrient compositions of these sources have not been evaluated, and the effects of different feed sources on growth and reproduction performances are still not well-known (5). Hence, to solve these problems, there is a need to investigate the acceptable feeds of snails in order to provide their nutritive requirement at a cheaper cost and also enhance their growth performance. We hypothesized that commonly available leaves and waste from foods can be used for efficient snail production.

This study assessed the effects of different feeds materials such as water melon peel, oil palm fruits, sweet potatoes leaves and cocoyam leaves on weight gain, shell length increase and circumference of African giant land snail (*Archachatina marginata*) under intensive management.

Materials and Methods

Experimental site

The feeding trial was conducted at the Teaching and Research farm of Agricultural Technology Department, Federal polytechnic, Ado-Ekiti, Ekiti State, Nigeria. The study area is located between latitude $7^{o}3'7''N7'12''N$ and latitude $5^{o}11''E$ and $5^{o}31''E$. The average annual rainfall in this area was 1300 mm, with average wet days of about 100. The annual temperature varies between 18°C to 34°C. The terrain in the study area is gently undulating, with topographic elevation ranging between 350 m and 370 m above sea level. The temperature-humidity index (THI), an indicator of thermal comfort level for animals in an enclosure was calculated as modified by Marai *et al.* (6)

Sample collection and preparation

The leaves of sweet potato (*Ipomoea batatas*) and cocoyam (*Colocasia esculenta*) were collected from Animal Production Research farm, Federal Polytechnic Ado Ekiti, Nigeria. The leaves were plucked, weighed and chopped into pieces before feeding it to the snails. Water melon peel (*Citrullus lanatus*) were collected from water melon sellers in the market. The peels were cut into pieces. Oil palm fruit (*Elaeis guineensis*) were also collected from Agricultural Processing farm, Federal Polytechnic, Ado-Ekiti. The oil palm fruits were crushed with stones and weighed before feeding. Chicken grower mash was used as control.

Experimental animals and management

Forty adult African giant land snails (mean weight 156.88 ± 0.27g) were obtained from the snail seller at Oja Oba market in Ado- Ekiti and acclimatized for two weeks. The snails were randomly grouped into five of four snails per group and were assigned to five dietary treatments. The treatments were replicated twice using a complete randomized design. Each group of the snails was stocked into a trench cage and filled with loamy soil up to 15cm thickness. The experimental diets and clean water were given daily.

Experimental diets

Snails fed Treatment 1 were given chicken grower's mash (control), T_2 (water melon peel), T_3 (oil palm fruit), T_4 (cocoyam leaves) and T_5 (sweet potatoes leaves), were housed in a trench cage. The snails were fed 5% body weight with their respective food once daily at 1800 hours for 56 days. Wetting of the snail enclosures with water was done twice daily at 0700 hours and 1830 hours in order to keep the environment humid for the snails to prevent hibernation. Regular cleaning of the snailry and utensils as well as routine management practices was ensured.

Table 1: Proximate composition of experimental diets

Component (%)	Chicken grower mash	Water melon Peel	Oil Palm Fruit	Sweet Potato Leaves	Cocoyam Leaves
Moisture content	18.76	38.12	28.01	28.17	23.74
Crude protein	13.12	14.17	7.64	7.96	7.66
Crude fibre	11.41	3.96	3.64	11.14	11.64
Ash	3.57	8 .64	4.76	6.68	6.55
Fat	7.12	5.88	3.12	3.74	3.20
Carbohydrate	44.96	35.28	46.67	42.31	53.76

Table 2: Growth performance of *Archachatina marginata* fed different feeds

Parameters	Chicken Mash	Water Melon Peel	Oil Palm Fruit	Sweet Potato leaves	Cocoyam leaves
Mean final length (cm)	13.88± 0.35^{c}	16.00± 0.76^{b}	17.00±0.00^{a}	13.75±0.75	13.75±0.07
Mean initial length (cm)	12.75±0.46^{c}	13.50± 0.93^{b}	13.63± 0.52^{a}	12.63± 0.74	12.63± 0.05
Length difference (cm)	1.13± 0.64	2.50± 1.06^{b}	2.67± 0.96^{a}	1.13±0.35	1.13±0.35
Mean final weight (g)	198.63±19.43^{c}	246.63±10.86^{a}	239.75±10.83^{b}	171.63±20.41^{d}	164.00±14.00^{e}
Mean initial Weight (g)	156.88±0.27^{c}	216.50±11.99^{a}	211.88±0.94^{b}	153.25±13.03^{c}	149.25±13.60^{d}
Weight difference (g)	41.75±19.16^{a}	30.13±2.71^{b}	27.88± 2.80^{c}	18.38±7.38^{d}	14.75±0.40^{e}
Mean final Circum. (cm)	1.36± 0.09^{c}	3.96±0.39^{b}	4.39 ±1.38^{a}	1.43±0.17^{c}	1.57± 0.13^{c}
Mean initial Circum. (cm)	1.34±0.09^{d}	1.46±0.39^{c}	1.72± 0.42^{a}	1.40±0.17^{c}	1.55 ± 0.13^{b}
Circumference diff. (cm)	0.02 ± 0.01^{c}	2.50± 0.01^{b}	2.67 ±0.96^{a}	0.03 ± 0.01^{c}	0.02 ± 0.01^{c}
Specific growth rate (%)	0.42	0.23	0.21	0.19	0.16
Daily weight gain	0.75	0.53	0.49	0.33	0.26
Percentage weight Gain (%)	26.61	13.91	13.16	11.99	9.88
Survival rate	100	100	75	50	75

$^{a, b, c, d}$ *Means with different superscripts along the same row are significantly different (P < 0.05).*

SGR = ln final weight- ln initial weight/ number of the experimental days x 100

DWG = total weight gain/number of the experimental days

PWG = final weight – initial weight/ initial weight x100

SR = number survived/number leased x100.

Data collection:

Data was collected at the onset of the experiment and subsequently on weekly basis by measuring growth parameters (shell length, shell circumference, and weight). Body weight was measured using a Metller® electronic scale to the nearest 0.01g, while shell

dimensional parameters were measured using Vernier caliper.

The average daily weight gain was determined by subtracting the initial weight from the final weight and then divided by number of the experimental days. The following parameters were obtained from the data collected viz:

(i) Specific growth rate (SGR) = ln final weight- ln initial weight/ number of the experimental days x 100
(ii) Daily weight gain (DWG) = total weight gain/number of the experimental days
(iii) Percentage weight gain (PWG) = final weight – initial weight/ initial weight x100
(iv) Survival Rate (SR) = number survived/number housed x 100.

Chemical analysis

The experimental diets were analysed in Biochemistry Laboratory, Department of Biological Science, Federal Polytechnic, Ado-Ekiti for proximate analysis. This was determined following the methods described by AOAC (7). The following parameters were determined: % Moisture content (MC), % Crude Protein (CP), % Crude Fibre (CF), % Ash, % Fat and % Carbohydrate (CHO).

Statistical analysis:

All data collected on growth performance of the snails were subjected to One Way analysis of variance (ANOVA) using IBM SPSS Version 20, and separation of treatment means was done using Duncan's New Multiple Range Test in the SPSS package (8).

Results and Discussion

The proximate composition of the experimental diets is shown on Table 1. Moisture content and crude protein in water melon peel (38.12% and 14.17%) were the highest followed by sweet potatoes leaves (28.17% and 7.96%); oil palm fruit (28.01% and 7.64%); and cocoyam leaves (23.74% and 7.66%). Likewise, crude fibre of cocoyam leaves (11.64%) were higher than other treatments while ash of the water melon peel (8.64%) was the highest. Also, CHO of cocoyam leaves (53.76%) were the highest while water melon peel (35.28%) recorded the lowest carbohydrate in the feed.

The growth performance of *Archachatina marginata* fed with chicken mash (control); water melon peel; palm kernel shell; sweet potatoes leaves and cocoyam leaves is revealed in Table 2. The weight gained by snails fed with chicken grower's mash (41.75±19.16g), were significantly higher than that gained by those fed with water melon peel (30.13± 2.71g), oil palm fruit (27.88±2.80g), sweet potato leaves (18.38±7.38g), and cocoyam leaves (14.75±0.40g). Also, those fed by water melon peel significantly ($p<0.05$) gained more weight than those fed with cocoyam leaves. From the study, it was revealed that snails fed compounded diets relatively retain more body protein than those on plant leaves. This might be due to the fact that available nutrients of the compounded diets originate from different feedstuffs thereby making them more balanced. This also agrees with the findings of Omole *et al.* (9) that weight gain of snail is directly proportional to the level of protein in the diet. Similarly, Akintomide (10), reported that African giant land snails like other farm animals prefer to be fed on a combination of feed ingredients rather than on a single ingredient or feed material.

Moreover, relatively low body protein content of the snails on cocoyam leaves agreed with the report of Ejidike (11) that cocoyam leaves are relatively poorly utilized by *A. marginata*. Additionally, the significant difference ($P<0.05$) observed in growth performance between those snails raised on cocoyam leaves and compounded feed might be due to the relatively high amount of fibre and lower protein content in the former than

the latter which may affect digestibility and feed utilization (12). Likewise, the significant difference ($P<0.05$) observed in the performance of snails raised on water melon peel compared with sweet potato and cocoyam leaves was likely due to higher crude protein of water melon peels.. Moreover, it may be more palatable, and various plant parts have different effects on animal tissues (13).

The shell length gain was similarly influenced by the experimental diets. Shell length gained by snails fed on oil palm fruit (2.67±0.96cm) and water melon peel (2.50±1.06cm) were significantly higher than those fed with sweet potato leaves (1.13±0.35cm). There was no significant difference ($P>0.05$) in the shell length difference of sweet potato (1.13±0.35cm) and cocoyam leaves (1.13±0.35cm). Research findings (14) agreed with this fact that snail fed with water melon peel significantly had the highest shell length gained because it contained some nutrients, such as vitamin A and C, calcium, potassium which play some important roles for the development of shell.

Ebenso (15) stated that African giant land snail (*Archachatina marginata)* increases in weight due to the quality of feeds given to them, which enhance the growth, reproduction and good health. According to Oyeagu *et al.* (16), the most important factor influencing the performance of animals under captivity, all other factors being constant, is the quality of diet offered to the animals. Martens *et al.* (17) reported that voluntary intake of leafy forage legumes is generally higher than that of grasses due to their lower fibre content and higher digestibility. The use of non-conventional feed materials in the feeding of non-ruminant animals has been shown to reduce the cost of production and enhance profit (18 and 19).

Conclusion and Application

1. It is deduced from this research that water melon peel can serve as feed material in snail feeds without having negative impacts on the growth performance of the snails
2. The utilization of water melon peel will aid in the reduction of waste and environmental pollution.
3. Snail farmers could use water melon peel in feeding snails especially during the dry season thereby reducing exorbitant price of snail during the period.

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